

REMARKS

Applicant has renumbered claims 1-6 as claims 36-41 based on the suggestion of the Examiner. However, to avoid confusion, applicant did not use the terminology “currently amended” along side the renumbered claims except for amended claims 36 and 38. Accordingly, only claims 36 and 40 are shown as being “currently amended” and claims 37, 38, 39 and 41 are indicated as previously presented based on the Preliminary Amendment.

The rejection of claims 1-6, now claims 36 to 41, under 35 USC 112, first and second paragraph, is respectfully traversed.

Applicant has amended claims 36 and 39 to clearly overcome the rejection under both the first and second paragraphs of 35 USC 112. The term “pre-decomposed product” in claim 36, has been changed to “decomposed product”. The expression “pre-decomposed” was intended to mean being decomposed before further decomposition with ethylene glycol in a subsequent step. Accordingly, use of the singular expression “decomposed product” should avoid any confusion.

Claim 36 has also been amended to specify the weight relationship of the aromatic polyester to the weight of the bis- β -hydroxyethyl terephthalate. Accordingly, claim 36 is now believed to be enabling for lower condensates. Accordingly, the rejection of claims 1-6 under 35 USC 112, first and second paragraphs, should now be withdrawn.

The rejection of claims 1-6, now claims 36-41, under 35 USC 103(a) as being unpatentable over JP06166747 (JP 747) in view of IN 145323 is respectfully traversed.

The content of ethylene glycol in “bis- β -hydroxyethyl terephthalate and/or a low condensate” as finally obtained in the present invention, based on a conventionally

derived calculation as hereinafter presented, is not less than 10.6 times the molar amount of terephthalic acid whereas in JP747 the content of ethylene glycol in the finally obtained oligomer, also based on a conventionally derived calculation as hereinafter presented, is not more than 3.3 times the molar amount of terephthalic acid. The calculation of the molar amount in each instance was derived as follows:

JP747 discloses that, for the decomposition of an aromatic polyester with alkylene glycol, a depolymerization reaction is first carried out by (i) adding the aromatic polyester to a reaction system in which an aromatic dicarboxylate and a low polymer thereof are existent in a molten state and (ii) adding alkylene glycol in an amount of 0.5 to 5.0 times the molar amount of the acid component constituting the above aromatic polyester (claim 1).

JP747 further teaches that the molar ratio of BHT as molten and stored is 1/4 to 2/1 based on 1 mol of the acid component of PET waste added in (i) (see the paragraph [0013]).

The case where the amount of the glycol component is the largest in the above reaction (i) of JP747 is when the amount of the BHT component based on 1 mol of the acid component of PET is 2 moles.

The molar ratio of the acid component to the glycol component in the reaction system of JP747 identified above as (i) is obtained as follows. Acid component: glycol component = (acid component of PET + acid component of BHT):(glycol component of PET + glycol component of BHT) = (1+2):(1+(2x2)) = 3:5

The case where the amount of the glycol component is the largest in the reaction identified above as (ii) is where ethylene glycol is added in an amount of 5.0 times the molar amount of the acid component of PET added to the reaction system of (i) as set forth in claim 1. In this case, the molar ratio of the acid component to the glycol

component in the reaction system is obtained as follows. Acid component:glycol component = (3):(5+5) = 3:10 = 1:3.33

Therefore, the amount of the glycol component contained in the final reaction product in JP747 is not more than 3.3 times the molar amount of the acid component.

The calculation of the final content of ethylene glycol relative to the molar amount of terephthalic acid for the subject invention is derived as follows:

In the present invention, the amount of the glycol component will be the smallest when (iii) 1 part by weight of an aromatic polyester is decomposed with 0.1 part by weight of bis- β -hydroxyethyl terephthalate and/or a low condensate thereof and then (iv) 1 part by weight of the decomposed product is reacted with 3.0 parts by weight of ethylene glycol. From the above reaction (iii) 1.1 parts by weight of the decomposed product is obtained. Since the molecular weight of PET is 192, the molecular weight of the glycol component (ethylene glycol component) is 44, and the molecular weight of BHT is 254, the molar ratio of the acid component to the glycol component for the above decomposed product is calculated as follows.

$$\begin{aligned}\text{Acid component: glycol component} &= (\text{acid component of PET} + \text{acid} \\ &\text{component of BHT}):(\text{glycol component of PET} + \text{glycol component of BHT}) = \\ &(1/192+0.1/254):(1/192+0.1 \times 2/254) \\ &= (0.0052+0.0004):(0.0052+0.0008) \\ &= 0.0056:0.0060\end{aligned}$$

Since 1.1 parts by weight of the decomposed product is used in the reaction (iv), ethylene glycol is used in an amount of 3.3 times the weight of the decomposed product. The molar ratio of the acid component to the glycol component in the reaction system (iv) is obtained as follows.

$$\begin{aligned}\text{Acid component: glycol component} &= 0.0056:(0.0060+3.3/62) \\ &= 0.0056:0.0592 \\ &= 1:10.6\end{aligned}$$

From the above, it is clear that the glycol component in the present invention is in an amount at least equal to 10.6 times the molar amount of the acid component.

It is therefore apparent that the present invention is significantly different in the content of ethylene glycol from the teaching in JP747.

Moreover, JP747 further teaches in paragraph [0018] that when the above molar ratio is higher than 5.0, not only is a unit of ethylene glycol and a unit of energy required for the removal of ethylene glycol during a polycondensation reaction but also the boiling point during the reaction drops, whereby the depolymerization reaction time is extended and the softening point of the regenerated PET lowers disadvantageously. Accordingly, for all of the above reasons, JP747 clearly teaches away from the present invention and does not suggest the present invention.

IN145323 discloses that polyethylene terephthalate waste is reacted with ethylene glycol to obtain bis(2-hydroxyethyl)terephthalate.

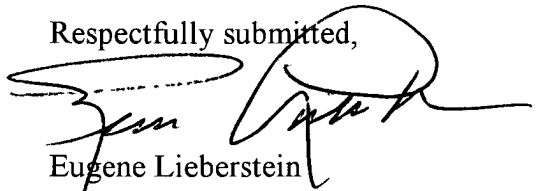
However, IN145323 fails to disclose a two-stage depolymerization reaction which is the characteristic feature of the present invention, that is, an aromatic polyester is heated together with a specific amount of bis- β -hydroxyethyl terephthalate containing no free ethylene glycol and/or a low condensate thereof to be pre-decomposed and then the obtained pre-decomposed product is reacted with a specific amount of ethylene glycol to convert the terephthalic acid component of the pre-decomposed product into bis- β -hydroxyethyl terephthalate and/or a low condensate thereof. Further, there is no

description in IN145323 about the weight ratio of polyethylene terephthalate waste to ethylene glycol.

For all of the above reasons, claims 36-41 are clearly patentable over JP 747 taken alone or in combination with IN 145323.

Reconsideration and allowance of claims 36-41 is respectfully solicited.

Respectfully submitted,



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